

Forests and International Carbon Markets

Climate and Forests 2030

AUTHORS

Nathaniel Keohane and Frances Seymour

EXPERT REVIEWERS

Pedro Moura Costa, Vedantha Kumar, Christina McCain,
Camilo Ortega, Mireille Perrin, and Felicity Le Quesne

Background

The Climate and Land Use Alliance (CLUA), with the support of Meridian Institute, is exploring the integration of climate and land use with justice, equity, health, and economic recovery through Climate and Forests 2030: Resources for Funders. This focus is intended to inspire innovation and investment in integrated work on forests, rights, and sustainable land use and will inform a new strategic plan for CLUA for the period 2021 to 2030.

To inform the thinking, CLUA commissioned a series of “thought pieces” to provide diverse inputs into developing a more integrated approach for forests and land use. These are meant to stimulate discussion and debate and are not intended to reflect the views of CLUA, its member foundations, or Meridian Institute.

The authors produced this paper in their individual capacities. Nathaniel Keohane is Senior Vice President for Climate at Environmental Defense Fund and serves on the board of the Emergent Forest Finance Accelerator. He gratefully acknowledges the significant contributions of Ruben Lubowski to this paper. Frances Seymour is a Distinguished Senior Fellow at World Resources Institute and serves as board chair of the Architecture for REDD+ Transactions. Many of her contributions to this paper draw on Seymour and Langer (2021), and she is grateful to Paige Langer for additional contributions. The authors also thank, without implicating, colleagues who provided invaluable comments, including Kelley Kizzier, Breno Pietracci, Katelyn Roedner, Steve Schwartzman, and Dan Zarin. They also thank the following reviewers for their helpful comments on a previous draft of this manuscript: Pedro Moura Costa, Vedantha Kumar, Christina McCain, Camilo Ortega, Mireille Perrin, and Felicity Le Quesne.



I. Introduction: The challenge and the opportunity

Conservation and restoration of tropical forests are essential to the well-being of humanity. Without a reversal of current trends in forest loss within the next 10 years, the goals of the Paris Agreement to avert a catastrophic rise in global temperature will be out of reach. In addition, values that forests provide related to biodiversity, agricultural productivity, public health, and cultural integrity of forest peoples will continue to be undermined.

In many ways, there has never been a better opportunity than the present moment to scale up support for global forest conservation and restoration. Public concern, spurred by the increasingly visible impacts of a changing climate, is generating new momentum for effective and immediate climate action. The Paris Agreement provides a framework for international climate action and cooperation. Governments are increasing the ambition of their commitments under the Paris Agreement as well as taking on net-zero targets (although implementation lags behind in many cases, and global emissions continue to rise). Corporations are committing to voluntary climate action, including through purchases of carbon credits.

Yet financial flows to protect and expand tropical forests lag far behind the potential of forests to advance climate mitigation, adaptation, and other sustainable development objectives. One proposed strategy for closing that financial gap is to include forest-based emissions reductions and removals in voluntary- and compliance-based carbon markets. REDD+,¹ negotiated under the UN Framework Convention on Climate Change (UNFCCC) and incorporated into the Paris Agreement, provides a framework for performance-based payments — via both public funding as well as carbon markets — to channel finance into tropical forest protection while creating positive economic incentives for forest emissions reductions and removals.

Whether and how REDD+ credits should be used in international carbon markets to meet voluntary targets and compliance obligations is the subject of intense scrutiny. The aim of this paper is to provide a succinct but comprehensive discussion of the key

issues in that debate.

The remainder of this paper proceeds as follows. Section II summarizes the critical role tropical forests play in stabilizing the climate and providing a range of other co-benefits, and briefly reviews the “finance gap” mentioned above. Section III explores the potential role of forest carbon markets to fill this gap and summarizes the status of and prospects for REDD+ credits in voluntary and compliance carbon markets. Section IV considers key concerns that have been raised around the environmental and social integrity of forest carbon markets and how those risks can be addressed. Section V looks ahead to identify a range of issues that are likely to arise in the coming years as the Paris Agreement is implemented and the use of forest carbon markets ramps up. Section VI identifies potential roles for public and philanthropic investment, and Section VII concludes.

II. Background: Tropical forest values, reducing deforestation, and finance

Tropical forests are essential to climate stability across scales and offer many co-benefits

Tropical forests have an essential role in addressing the climate crisis. The arithmetic is simple: in 2019, land use change (of which tropical deforestation is the prime component) netted 5.5 gigatonnes of carbon dioxide (GtCO₂) emissions, or roughly 10% of anthropogenic greenhouse gas emissions (expressed in terms of 100-year global warming potential). At the same time, intact terrestrial ecosystems (again, mostly forests) absorb on the order of 11 to 12 GtCO₂ emissions each year. Continued loss of forests, therefore, represents a double hit to the atmosphere: an increase in emissions and a decrease in sequestration capacity. The hit becomes a triple when forests are replaced by a high-emissions land use such as cattle ranching.

For these reasons, as the *IPCC Special Report on Global Warming of 1.5°C* (IPCC 2018) made clear, global temperature goals are simply not achievable without halting and reversing tropical deforestation

¹ See Box 1 for relevant terms.

within the next decade, and the *IPCC Special Report on Climate Change and Land* concluded that reducing rates of deforestation and forest degradation “represents one of the most effective and robust options for climate change mitigation” (IPCC 2019). Reduced deforestation and restoration of forests, wetlands, and peatlands together account for roughly half of the estimated reduction potential from the land sector between now and 2050 consistent with a 1.5°C pathway (Roe *et al.* 2019).

In addition, the conservation and restoration of tropical forests provides a suite of additional climate-related benefits beyond storing carbon. Forthcoming research suggests that tropical forests’ global cooling effect may be amplified by up to one-third based on

biophysical effects on global temperature through pathways such as evapotranspiration, cloud formation, and effects on wind and global circulation patterns (Lawrence *et al.* forthcoming). The role of tropical forests in generating rainfall at continental scales through terrestrial moisture recycling is increasingly accepted, as is its importance for agriculture and food security far beyond the forest areas (Lawrence and Vandecar 2014). At more local scales, forests moderate temperature extremes, with important implications for agricultural productivity and public health.

Because the Amazon and other natural ecosystems are themselves being affected by deforestation and climate change in ways that may render them less

BOX 1. Key concepts in forest carbon credits: A primer

Reducing Emissions from Deforestation and forest Degradation (REDD+) includes the role of conservation, sustainable management of forests, and enhancement of forest carbon stocks in developing countries. (Section III provides a brief history of REDD+)

Carbon markets: Voluntary vs compliance. In this paper, we use the term “carbon markets” broadly to refer to institutions in which *credits*, denominated in tonnes of CO₂-equivalent, are generated by verified reductions in greenhouse gas emissions or removal and storage of CO₂, and are purchased to be used toward fulfilling a climate commitment (or in some cases retired). We use the term “forest carbon markets” to refer to the inclusion of credits from forest emissions reductions or removals.

In *voluntary* markets, demand for credits comes from companies (or other entities) that have voluntarily taken on commitments to financing climate action outside their value chains (see discussion in Box 4 on p.10). Credits for voluntary markets are generated according to methodologies developed by standards organizations, which also oversee the verification, validation, and registration of credits.

In *compliance* markets, demand for credits comes from entities subject to some legal limit on emissions that can be met, at least in part, using eligible credits. For example, a state or national emissions trading program, or an international

market-based measure such as the aviation sector’s CORSIA program (see p.11), may allow covered entities to purchase approved credits to offset a portion of their emissions. (Note that throughout this paper, we use “offset” to refer specifically to the use of carbon credits to balance or “offset” emissions under a regulatory regime.)

Although the Paris Agreement does not establish a “market” for credits, in this paper, we use the term “compliance market” broadly to include transactions under Article 6 of the Agreement, which recognizes the use by Parties of *internationally transferred mitigation outcomes* toward the fulfillment of nationally determined contributions (NDCs).

This paper focuses on *international* carbon markets, in which a carbon credit is used toward a voluntary or compliance obligation under an international agreement, or in a country other than the host country in which the emissions reduction or removal occurs.

Project vs. jurisdictional scale. Reductions in emissions from deforestation may be measured and credited either at the scale of an individual *project* intervention (the largest of which cover an area of a few hundred thousand hectares), typically managed by private project developers; or a program at the scale of an entire *jurisdiction* (defined as a nation or a subnational unit such as a state or province, sometimes along with a minimum area requirement), led by the government of the jurisdiction. Projects may also be “nested” within jurisdictional-scale accounting frameworks.

able to store carbon in the future (Anderegg *et al.* 2020), protecting them now is essential to curtail emissions from land use change and buy valuable time to develop additional mitigation and adaptation options. The possibility of the ongoing deforestation and degradation of the Amazon reaching a level which unleashes the tipping-point dynamic of unavoidable savannization would have massive global consequences (Lovejoy and Nobre 2019).

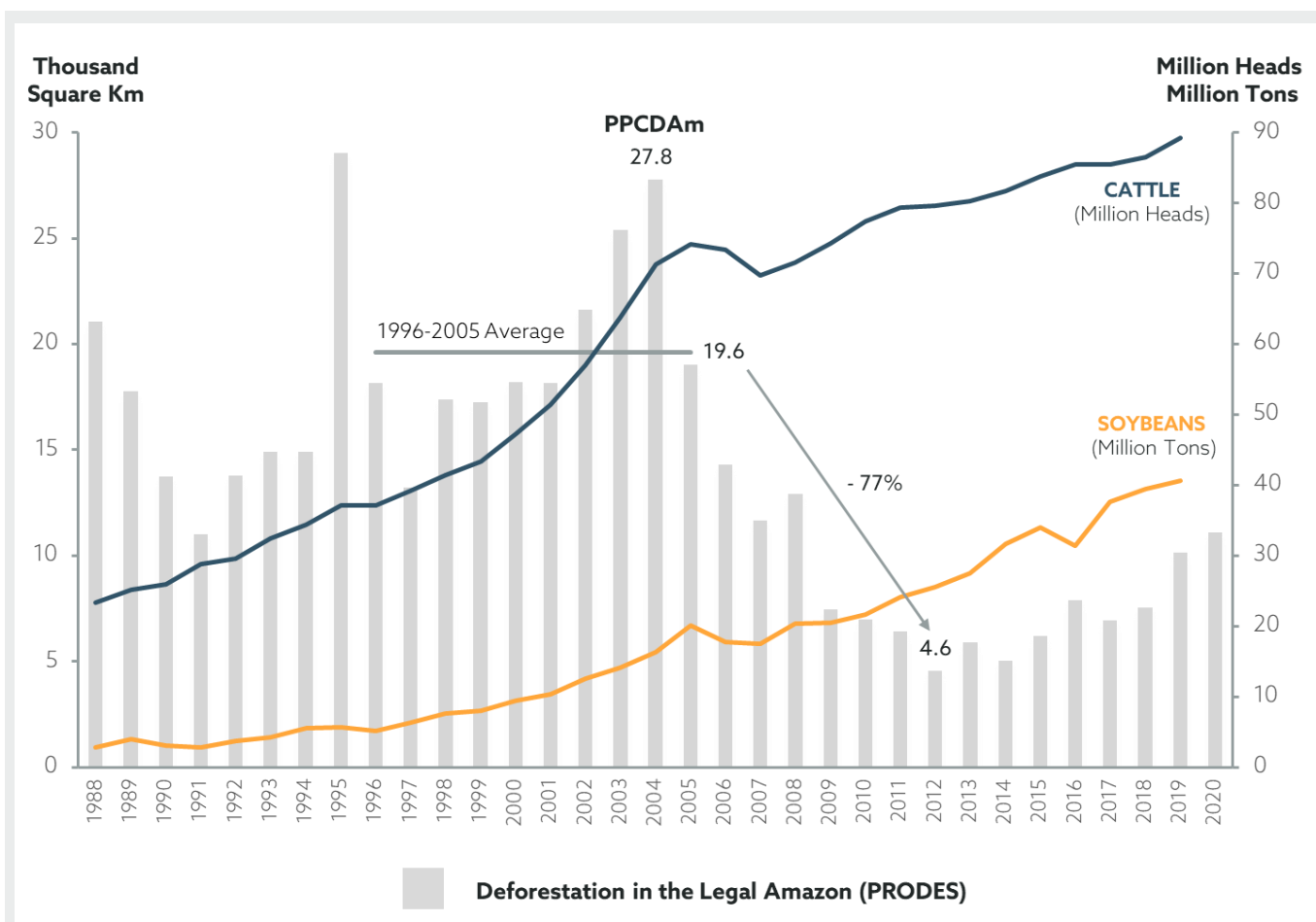
In addition to these impacts on climate stability, tropical forests harbor the preponderance of the Earth's terrestrial biodiversity (Raven 1988), provide on average more than one-fifth of local incomes (Angelsen *et al.* 2014), and support important cultural and spiritual values to indigenous and traditional communities (Smith and Sherr 2003). For these reasons and more, the *IPCC Special Report on Climate Change and Land* concluded that improved forest management and reduced deforestation and

degradation were among the few land-based mitigation options that provide unambiguously positive contributions to climate adaptation, biodiversity conservation, and other Sustainable Development Goals (SDGs).

Experience in Brazil demonstrated how to reduce deforestation

The revolution in satellite-based monitoring technology and availability of data that has occurred over the last decade has enabled a flourishing of research on the direct and underlying causes of deforestation, as well as the efficacy of various efforts to stop it (Seymour and Harris 2019; Busch and Ferretti-Gallon 2017). Brazil's remarkable reduction of deforestation in the Amazon over the period 2005-2012 illustrates what is possible when backed by political will (Box 2).

FIGURE 1: Annual deforestation in Brazilian Amazon, 1988 - 2020



Source: INPE - National Space Research Institute; IBGE - Brazilian Institute of Geography and Statistics.

BOX 2. Lessons from Brazil's remarkable decade of reducing deforestation

Between 2005 and 2012, Brazil reduced deforestation in the Amazon by over three-quarters compared to the 1996-2005 reference level (Figure 1). The resulting cumulative emissions reductions of more than 3 billion tonnes of CO₂ made Brazil the world's leading nation in terms of emissions reductions over that time span (Nepstad *et al.* 2014).

Brazil's unprecedented success offers important lessons for the future. First, deforestation can be decoupled from agricultural production. Brazil's record success was achieved while substantially increasing production of soy and beef (Figure 1) (Boucher and Chi 2018; Koch *et al.* 2019). Second, domestic government policy and political will is crucial. The development of the interministerial Plan for the Prevention and Control of Deforestation in the Legal Amazon (PPCDAm) established a crosscutting, coordinated approach at the federal level. The creation of protected areas and recognition of indigenous territories, improved satellite monitoring, and law enforcement and agricultural credit restrictions that were aggressively enforced by the federal government over that period were among the principal drivers of reduced deforestation (Nepstad *et al.* 2014; Assunção *et al.* 2015).

Third, state governments have a critical role to play. The state of Acre provides a model (Schwartzman 2015). To drive reductions in deforestation emissions, Acre established a strong institutional framework and incentives system for REDD+, including a spatially-explicit land use plan that designates zones based on drivers of deforestation and sets strategies to address them, as well as a robust monitoring system. Acre's Incentive System for Environmental Services (SISA) program provides payments to those who provide ecosystem services, as opposed to those that own the land or trees — avoiding conflicts over land tenure and facilitating rewards for indigenous peoples and traditional communities with low historical deforestation rates. Acre established a public-private Environmental Services Development Company (CDSA) to interface

with investors, help raise finance, and commercially manage the state's carbon and other environmental assets. The state government also invested in infrastructure, training and technical assistance and formed public/private/community partnerships to pursue low-emissions economic development, including successful cooperative processing plans and marketing networks for Brazil nuts and fruits.

Fourth, international attention — and the engagement and support of actors outside Brazil that such attention generated — also played a central role. Results-based financing programs, including contributions to the Amazon Fund, supported by Norway, and support for Acre and Mato Grosso from Germany and the UK via the REDD Early Movers (REM) Programme, bolstered political will, provided finance, and otherwise supported these efforts (Birdsall *et al.* 2014). Policy actions were complemented by market signals from consumer goods companies with deforestation-free supply chain commitments (Nepstad *et al.* 2014).

Deforestation has increased since 2012, beginning with revisions to Brazil's Forest Code and accelerating in recent years under the Bolsonaro government's policies of deregulation, defunding enforcement, and promoting deforestation. This increase itself underscores the critical role played by government policy — and political will — in protecting forests, and the importance of nurturing both domestic constituencies and international incentives for sustaining them. Nonetheless, Brazil's experience indicates that jurisdictional-scale efforts to address deforestation can achieve rapid reductions in emissions at very large scales. Moreover, the reduced emissions achieved over the period, even as agricultural commodity production increased, represent significant and lasting gains to the atmosphere, relative to what would have happened in the absence of policy.

Finance to protect and restore tropical forests is less than one-tenth its mitigation potential

Despite the growing awareness of the central role of tropical forests in stabilizing the climate, and the increased understanding of how to reduce deforestation while supporting sustainable economic development, financial flows to protect and expand forest cover lag far behind the potential of forests to advance climate mitigation, adaptation and other sustainable development objectives. It is this gap that provides the critical potential role for carbon markets, which are capable of mobilizing finance at much greater scales.

Public international flows for forests and commitments for performance-based REDD+ finance averaged only about \$1 billion per year between 2010 and 2017 (Climate Focus 2017). Estimates of the total cost of achieving deep (50-75%) cuts in global deforestation emissions run into the high tens of billions of dollars annually (Busch *et al.* 2019; Kindermann *et al.* 2006). A more policy-relevant figure may be the *international* financial flows required to support significant reductions in deforestation, as distinct from efforts within tropical forest countries. New research indicates that cost-effective implementation of current NDCs would entail about 1 billion tonnes of international REDD+ transactions per year (over and above what countries would do domestically) at prices of \$10-\$20 through 2035. A 2°C-consistent scenario would, in theory, entail double the volume at \$50-\$100 prices (Piris-Cabezas *et al.* 2019; Piris-Cabezas *et al.* 2021).

As another benchmark for comparison, existing financial flows for tropical forest protection continue to be dwarfed by perverse public subsidies and private investment in activities that can drive deforestation. The \$1 billion in annual international public flows cited above compares to an annual average of more than \$34 billion in domestic subsidies to commodities that drive deforestation in Brazil and Indonesia alone. Further, average annual international flows of “grey” (not environmentally-sensitive) finance to the land sector over the same period totaled almost \$100 billion (Climate Focus 2017).

Mobilization of forest finance through carbon markets is only one strand in a larger braid of initiatives necessary to shift economic incentives from forest

destruction to forest protection. These initiatives include redirecting perverse agricultural and biofuel subsidies, getting deforestation out of commodity supply chains and financial portfolios, and enforcing existing laws. However, placing a market value on forest carbon is arguably of outsized importance due to its role in incentivizing many of these other complementary actions.

Financial flows to protect and expand forest cover lag far behind the potential of forests to advance climate mitigation, adaptation and other sustainable development objectives.

III. The role of markets for forest carbon

At a basic level, the rationale for forest carbon markets derives from the moral imperative of providing significant forest finance to developing countries. Exploitation of natural resources, including native forests, fueled the development and economic growth of today’s advanced economies, even as those nations emitted massive quantities of carbon dioxide into the atmosphere. As a result, the world confronts a rapidly warming planet, and an urgent need to protect remaining forests — especially in the tropics — in order to stabilize the climate. If the world is to stave off climate catastrophe without dooming capital-poor and natural resource-rich developing nations to poverty, we need ways of channeling finance into new models of economic development that produce the food and fiber the world needs while sustaining local communities and protecting the carbon stored in natural systems. That is what REDD+ is designed to do — and, as discussed later in this section, what market-based REDD+ can do at scale with appropriate guardrails on both the supply side and the demand side of transactions.

The rationale can also be expressed in economic terms. Tropical forests are destroyed for economic gain: commodities such as beef, soy, palm oil, and timber yield profit, while standing forests typically do not. REDD+ helps to correct that calculus, and in so doing addresses a key root cause of tropical forest loss: the lack of economic incentives to protect and restore forests and the carbon they contain. In the

absence of such incentives, tropical forest governments may lack resources and political will to enforce environmental laws, maintain protected areas, empower indigenous and local communities, align fiscal policies, and promote other green growth development policies. Even when more sustainable activities are economically attractive, smallholders and other producers may lack the necessary up-front capital or expertise to transition to higher productivity models with a smaller environmental footprint.

By rewarding verified reductions in emissions from deforestation and forest degradation and removals from forest regrowth, REDD+ creates value for the carbon contained in standing tropical forests or sequestered through restoration. That value, in turn, creates positive economic incentives that can sustain durable forest protection and encourage both governments and private actors to transition to more sustainable models of agricultural and rural economic development.

For REDD+ to work in practice, payments must be tied to actual emissions reductions and must flow to those who protect the forest and who depend on the forests for survival, in addition to creating incentives to innovate new development and economic models. Ensuring that those conditions are met is the role of standards, to which we turn next.

Finally, these positive incentives result from REDD+ programs whether they are funded by public sources of capital, via official development assistance, or by private sources, via markets. The difference is that private sources promise to be at least an order of magnitude larger, as we show in the final two parts of this section.

The evolution of REDD+ standards

The importance of forests as “carbon sinks” was recognized as early as the 1980s, and the first generation of forest-carbon initiatives, including the Noel Kempff project in Bolivia and Costa Rica’s national program, dates back to the 1990s. In 2005, a team of Brazilian and American scientists proposed rewarding tropical forest countries for verified reductions in emissions from deforestation, which they termed “Compensated Reductions” (Santilli *et al.* 2005). In the same year, the newly-created

Coalition for Rainforest Nations (CfRN) introduced into the UN climate negotiations a draft proposal titled “Reducing emissions from deforestation in developing countries: approaches to stimulate action.” After several years of technical negotiations, REDD+ was formally recognized in the UN Framework Convention on Climate Change (UNFCCC) at COP19 in Warsaw in 2013. The Warsaw REDD+ Framework established a national approach to eligibility for REDD+ results-based payments, including baselines, monitoring systems, strategies, and safeguards information systems, allowing for sub-national implementation on an interim basis. Two years later, REDD+ was enshrined in Article 5 of the Paris Agreement.

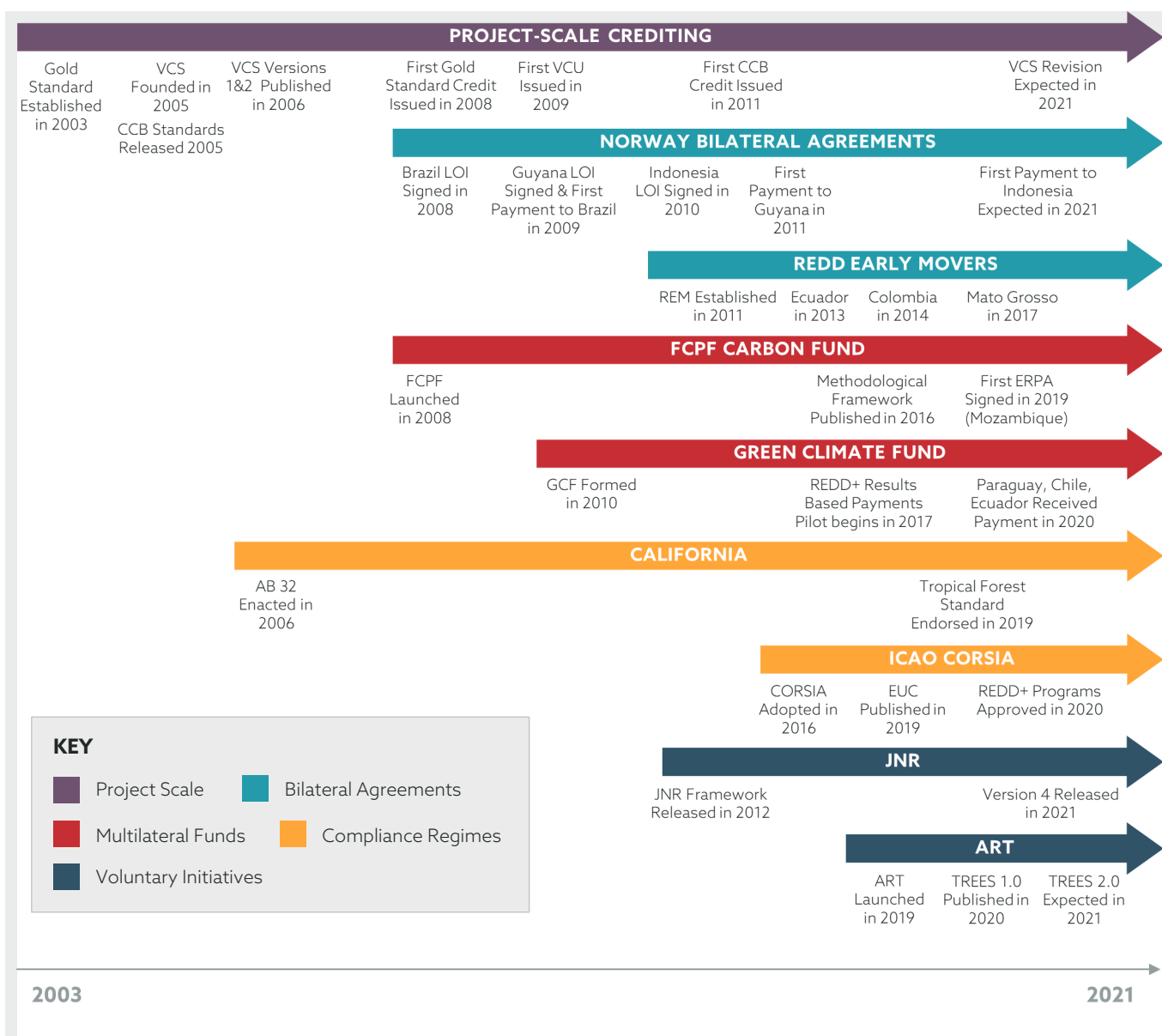
In parallel, methodologies have been developed to quantify emissions from reduced deforestation, as the basis for generating REDD+ credits. Of particular relevance for market-based REDD+ are the frameworks for project-based crediting released by the American Carbon Registry and Verified Carbon Standard (VCS) in 2012; the VCS Jurisdictional and Nested REDD+ (JNR) framework in the same year; and The REDD+ Environmental Excellence Standard (TREES) released by the Architecture for REDD+ Transactions (2020). Standards have also been developed to reward emissions reductions from jurisdictional REDD+ programs through results-based finance provided by public sector donors.² Figure 2 illustrates the evolution of these standards over time, as well as the long gestation period between the initiation of public sector programs and the first performance-based payments.

The growing role of the voluntary carbon market

Voluntary corporate commitments to enhanced climate action present a significant new source of prospective demand for forest-based emissions reductions and removals credits. As of early 2021, voluntary net-zero and climate neutrality commitments had tripled since 2019, with more than 1,500 companies having made commitments to get to “net-zero” emissions by 2050 or sooner.

When viewed in terms of transaction volumes, the history of the voluntary carbon market is one of ups and downs. According to Ecosystem Marketplace,

² REDD+ standards for public finance include the jurisdictional Acre Carbon Standard used to issue units paid for by Germany’s development bank KfW beginning in 2012; the Methodological Framework of the Forest Carbon Partnership Facility (FCPF)’s Carbon Fund; and the scorecard for piloting results-based payments for jurisdictional REDD+ developed by the Green Climate Fund (GCF) in 2017.

FIGURE 2: The evolution of forest carbon credit standards**LIST OF FIGURE 2 ACRONYMS**

AB Assembly Bill

ART Architecture for REDD+ Transactions

CCB Climate, Community, & Biodiversity

CORSIA Carbon Offsetting and Reduction Scheme for International Aviation

ERPA Emissions Reductions Payment Agreement

FCPF Forest Carbon Partnership Facility

GCF Green Climate Fund

ICAO International Civil Aviation Organization

JNR Jurisdictional and Nested REDD+ Framework

LOI Letter of Intent

REM REDD Early Movers

TREES The REDD+ Environmental Excellence Standard

VCS Voluntary (later changed to Verified) Carbon Standard

VCU Verified Carbon Unit

voluntary market transactions for all sectors reached almost 100 million tonnes of CO₂e (MtCO₂e) in 2018 and 104 MtCO₂e in 2019, with values of \$296 million and \$320 million per year, respectively.³ While this level of activity represents a more than doubling relative to the all-time low in 2017, it remains below the peak years of 2008-2010, when volumes averaged 118 MtCO₂e per year, with average values of \$516 million per year.

A better measure of voluntary market demand, at least in terms of underlying emissions reductions, is the volume of credits issued and retired (TSVCM 2021, p. 42). Viewed in this light, the history of the voluntary carbon market is one of stasis followed by rapid growth in recent years. From 2009 to 2016, issuances rose slowly from 29 to 49 MtCO₂e per year and then fell back to 34 MtCO₂e. Beginning in 2017, however, issuances began to climb rapidly, reaching 138 MtCO₂e in 2019 and 181 MtCO₂e in 2020. Retirements (a measure of end-use demand) show a broadly similar pattern: almost nonexistent in 2009-2012 and flat at 32 to 38 MtCO₂e in 2013-2016, followed by a sharp increase beginning in 2017 to reach 95 MtCO₂e in 2020.

While detailed information on issuance and retirement by project type is unavailable, transaction volume data suggests that the recent growth was driven principally by interest in forest and land-based credits, whose volumes rose sharply from about 14 MtCO₂e in 2016 to 51 MtCO₂e in 2018 and 37 MtCO₂e in 2019 (2020 transactions data is not yet available). REDD+ credits accounted for the lion's share of forest and land-based credits, reaching 31 MtCO₂e in 2018 and 23 MtCO₂e in 2019 (or roughly 30% and 20%, respectively, of the total market volume). Given average prices of \$3-\$4/tonne, this corresponds to roughly \$100 million in value. For comparison, the peak year of 2010 saw 37 MtCO₂e in REDD+ credits, but that was an anomaly in retrospect with REDD+ volumes only about 7 MtCO₂e in each 2009 and 2011. It's important to note that to date, completed REDD+ transactions in the voluntary private market have consisted almost exclusively of project-based

credits.⁴

The overall picture of the voluntary market for REDD+ credits, therefore, appears to be one of generally strengthening demand in the context of rapidly growing voluntary carbon market demand. How large is this potential market? Based on a survey of market observers, the Taskforce on Scaling Voluntary Carbon Markets estimates voluntary market demand as scaling by an order of magnitude to roughly 1 billion tonnes (1 GtCO₂e) per year in 2030 (TSVCM, p. 55), with annual values in the tens of billions of dollars. These estimates are necessarily rough and comprise all project types (not just forest carbon). Nonetheless, if REDD+ were to account for roughly a quarter of that future market, in line with recent transactions data, it would suggest demand for forest carbon credits of roughly 250 MtCO₂e/year and financial flows in the billions of dollars. This estimate provides a sense of the potential scale of voluntary forest carbon market demand.

A concrete sign of the potential increase in voluntary market demand can be seen in the LEAF Coalition announced on April 22, 2021 at the virtual Climate Leaders Summit.⁵ A joint initiative of the governments of the U.S., UK, and Norway and nine participating companies, facilitated by the Emergent Forest Finance Accelerator, the coalition pledged to mobilize at least \$1 billion in 2021 for emissions reductions from tropical and subtropical forests that meet the ART/TREES Standard, with at least half of that expected to come from the private-sector participants. The coalition issued a Call for Proposals from tropical and subtropical jurisdictions, and received initial public expressions of support from the governments of Costa Rica, Guyana, and Peru, as well as the Brazilian state of Maranhão. The first tranche of transactions is expected to be completed by COP26, for emissions reductions in 2022-2026; when executed, these will be the first private-sector transactions of jurisdictional REDD+. Company participants have indicated that if the first round of LEAF is successful, significantly more transactions could follow — potentially representing billions of

³ All data on voluntary carbon markets taken from Ecosystem Marketplace's annual publication of *State of the Voluntary Carbon Market, 2007-2020*, available online at <https://www.ecosystemmarketplace.com/carbon-markets>.

⁴ In April 2021, Carbon Pulse reported a purchase of 6,100 national-scale "REDD+ Results Units" from Papua New Guinea by Blackstone Energy Services on the REDD.plus trading platform launched in 2019 by the Coalition for Rainforest Nations. In FY11, BP Technology Ventures contributed \$5 million to the World Bank's Forest Carbon Partnership Facility Carbon Fund.

⁵ LEAF stands for "Lowering Emissions by Accelerating Forest finance." The initial nine participating companies are Airbnb, Amazon, Bayer, Boston Consulting Group, GSK, McKinsey & Co., Nestle, Salesforce, and Unilever. See <http://leafcoalition.org> for details.

BOX 3. The unclear role of forest carbon credits in meeting corporate net-zero targets

An unresolved issue that will determine the size of voluntary corporate demand for forest carbon credits is the extent to which purchases of such credits are recognized as a legitimate component of strategies to meet net-zero targets, and if so, the nature of claims that companies can make based on those purchases.

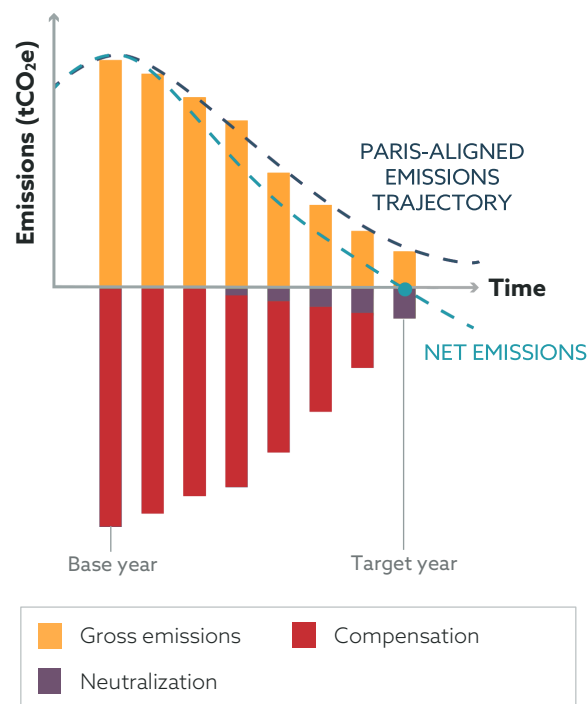
A leading framework for corporations seeking to make and implement net-zero targets is the Science-Based Targets initiative (SBTi), which published initial guidance in 2020 (SBTi 2020). In the SBTi's preferred "climate positive" approach to achieving net-zero targets illustrated in Figure 3, companies are required to pursue a "Paris-aligned" trajectory of **abatement**, defined as the reduction of GHG emissions *within* the operations of the company and its value chain. Companies are not allowed to substitute for abatement within that trajectory with offsets of any kind.

As companies approach the technological limits of abatement in the latter part of the trajectory, they are expected to balance any residual emissions with **neutralization** measures – that is, the removal from the atmosphere and permanent storage of GHG emissions, either through technological approaches such as direct air capture and geological storage of CO₂, or through removal and long-term storage in biological systems, including forests.

In addition, companies are encouraged to **compensate** for current emissions at each step on that trajectory, by financing of reduction of GHG emissions *outside* the operations of the company and its value chain. Financing reduced emissions from deforestation as well as removals from forest restoration could be included as compensation under the SBTi framework.

However, two sources of uncertainty remain. First is the level of abatement required before companies could be granted a "social license to offset" by compensating remaining emissions at any given point in the trajectory. Companies in different sectors face very different technological and cost barriers to abatement, and SBTi has so far published sector-specific guidelines for only a few sectors, and none is available for the oil and gas sector.⁶

FIGURE 3: Compensation and neutralization offsets in net-zero emissions strategies



Source: SBTi (2020)

The second issue is whether and how companies will be rewarded for going beyond abatement to invest in compensation. As of early 2021, SBTi was focused on providing guidance on abatement and neutralization and was not planning to recognize associated claims such as "carbon neutral" based on compensation. Further, SBTi had floated a proposal that corporate investment in compensation be denominated in dollars rather than tonnes, potentially undermining the connection between compensation and climate action (SBTi 2021).

These issues proved central to the recently-announced LEAF Coalition. Private sector participants explicitly agreed to meet a set of criteria, including publicly committing to science-based targets (SBTi) or equivalent quantified and independently verified decarbonization targets; joining the UN Race to Zero; publicly reporting a greenhouse gas emissions inventory using the Greenhouse Gas Protocol; and publicly reporting on the use of emissions reductions.

Source: Based on Seymour and Langer (2021)

⁶ Other sectors can use SBTi's default Absolute Contraction Approach, which utilizes a straight-line abatement path to aligned to a 1.5°C target.

dollars of demand from the voluntary market over the coming decade.

Many companies have made explicit reference to the role of nature-based climate solutions in meeting net-zero targets. For example, Apple has incorporated forests and other nature-based climate solutions into its carbon removal strategies for neutralizing supply chain emissions that cannot be addressed through shifts to renewable energy.⁷ Nonetheless, the role of forest carbon credits in meeting corporate net-zero targets remains unsettled (see Box 3). Perhaps in part as a consequence of this lack of clarity, there has

been a growing interest among some participants in the voluntary market in “removing” carbon by planting trees, rather than reducing deforestation of existing forests — which arguably has much greater benefits for the climate, ecosystems, and forest communities (see Box 4).

The prospects for REDD+ in compliance carbon markets

Currently nearly 25% of global greenhouse gas emissions — in countries accounting for over 40% of global GDP — is covered by some form of carbon

BOX 4. The perverse preference for planting trees rather than protecting forests

A feature of the recent corporate embrace of “nature-based solutions” to climate change is a relative emphasis on tree-planting rather than protection of remaining forests. For example, new commitments announced with the launch of a “trillion trees” initiative at the World Economic Forum in 2020 were formulated in such terms (Seymour 2020).

One explanation for this emphasis is that some companies have (mis)interpreted SBTi’s guidance on net-zero targets (see Box 3) that distinguishes between compensation and neutralization as suggesting that forest-based emission reductions are inferior to forest-based removals achieved through reforestation and restoration, as only the latter “count” as measures to neutralize residual emissions at the end of the net-zero pathway. Others may worry about the environmental integrity of emissions reductions compared to removals or see superior branding opportunities or employee involvement associated with tree-planting initiatives. However, both emissions reductions and removals are needed, with a premium on stopping the loss of intact forest ecosystems in the near term through the finance of emission reductions, for several reasons.

First is the simple math from the perspective of the atmosphere. Preventing the loss of a hectare of tropical forests avoids an immediate pulse of emissions on the order of 300 tonnes of CO₂. By contrast, tropical reforestation on average

sequesters only 3% of that amount annually (IPCC 2018). Indeed, much carbon stored in forests and wetland ecosystems is “irrecoverable” in the relevant timeframe, meaning that restoration is not possible by mid-century (Goldstein *et al.* 2020). In light of the time value of keeping carbon out of the atmosphere — i.e., preventing a tonne of emissions now is more valuable than removing a tonne of emissions later — preventing forest loss is the priority for mitigation action.

The second, related, reason is that because 30 times more land is needed for reforestation to generate the same mitigation outcome as avoided deforestation, reforestation risks competition with other land uses such as agricultural production, thus threatening food security. The IPCC singles out mitigation options that do not require land use change, such as the protection and sustainable management of forests, as “no regrets” options (IPCC 2019).

The third reason is that forest loss also entails the immediate loss of the non-carbon ecosystem functions of forest cover for climate stability and other objectives. These functions include moderation of local temperatures, generation of rainfall, and conservation of biological diversity, which cannot be quickly or easily reestablished through forest restoration. The possibility of forest loss leading to tipping points makes stopping deforestation an urgent priority.

Source: Seymour and Langer 2021.

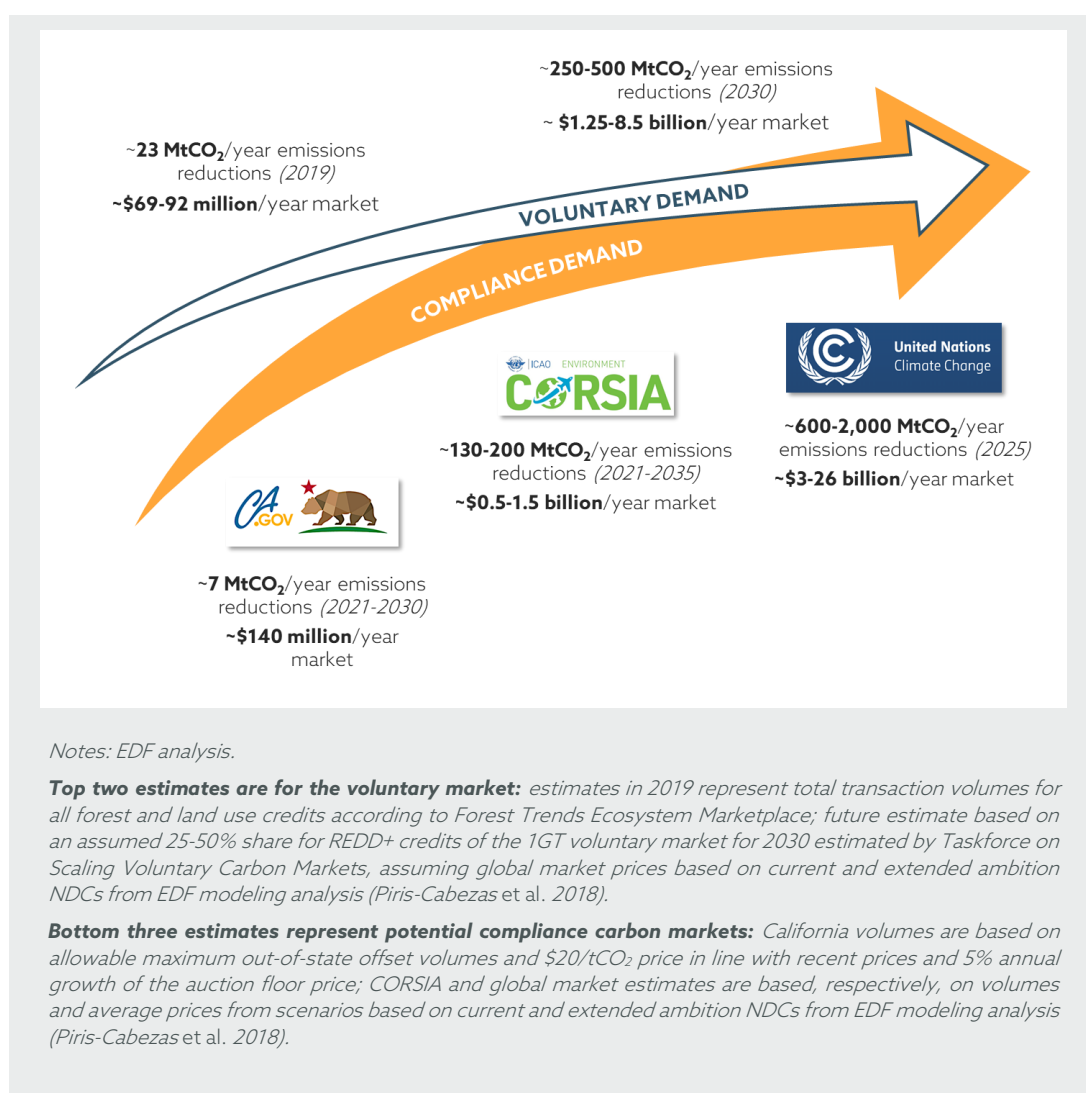
⁷ See <https://www.apple.com/newsroom/2020/07/apple-commits-to-be-100-percent-carbon-neutral-for-its-supply-chain-and-products-by-2030/>.

pricing system. Nearly 100 nations have explicitly indicated their interest in using such market approaches to help meet their pledges under the Paris Agreement. In addition, governments seeking to increase the ambition of their Paris Agreement pledges are considering mitigation partnerships that could include commitments to increasing funding for verified emissions reductions from forests.

As a result, the *potential* size of compliance markets for forest carbon credits is enormous. However, most compliance markets currently do not allow the use of forest carbon credits. In January 2021, the Carbon

Offsetting and Reduction Scheme for International Aviation (CORSIA) program of the International Civil Aviation Organization (ICAO) became the world's first international compliance market to accept REDD+ credits.⁸ CORSIA caps CO₂ emissions from international air travel between participating countries; airlines must offset emissions above the cap by purchasing and retiring credits from approved programs. In 2020, ICAO approved seven programs for eligibility in CORSIA, including two jurisdictional REDD+ standards: the Verra JNR framework and ART/TREES.

FIGURE 4: Potential scaling of voluntary and compliance REDD+ markets



⁸ California's cap-and-trade system and Colombia's carbon tax allow the use of domestic forest carbon credits to meet a capped percentage of compliance obligations, or to be used in lieu of tax payments, respectively.

Two jurisdictions with emission trading programs could become sources of international demand for jurisdictional REDD+ in coming years: California and the Republic of Korea. In 2019, the California Air Resources Board endorsed the California Tropical Forest Standard (TFS), which sets out requirements that jurisdictional REDD+ programs would need to meet in order to be eligible to link with California's program in the future (see Box 5). Korea, whose emissions trading system currently accepts other international credits, has been piloting REDD+ initiatives and exploring the potential for international climate cooperation on forests.

Looking further ahead, Article 6 of the Paris Agreement lays the groundwork for the use of international carbon markets as a form of cooperation to meet NDCs. Countries that choose voluntarily to use internationally transferred mitigation outcomes ("ITMOs") toward their NDCs must promote sustainable development, ensure environmental integrity and transparency, and must apply robust accounting to ensure the avoidance of double counting. Jurisdictional REDD+ credits consistent with the UNFCCC Warsaw REDD+ Framework would be a form of ITMOs.

How large are the potential financial flows from compliance carbon markets? As Figure 4 illustrates, CORSIA alone can provide on the order of a billion dollars in annual demand, while the potential for transactions of ITMOs under the Paris Agreement is an order of magnitude greater than that. As a result, compliance markets have the potential to channel billions of dollars annually to forest protection — several times recent public funding flows, and a significant step toward closing the finance gap identified in the introduction.

A commonly-expressed concern is that including forest carbon credits in international carbon markets will detract from the urgent need to reduce emissions from fossil fuels. We consider this risk in the next section. For now, we note that by lowering the cost of cutting carbon emissions, allowing REDD+ credits in markets could potentially enable more stringent targets. In other words, the gains from trade in markets can be translated into greater overall ambition. Modeling analysis suggests that the use of international carbon markets, including forest carbon credits, could nearly double the emissions reductions countries could achieve overall, relative to their first

round of NDCs — for the same total cost. Over half of that potential gain is due to the inclusion of forest carbon. The gains from trade are even larger in scenarios in which NDCs are scaled up in line with a 2°C target (Piris-Cabezas *et al.* 2020).

Indeed, the true economic value of forest carbon markets to society may run into the trillions of dollars in net present value: given the slow pace of overall mitigation, rapid deployment of REDD+ could keep the option open for more ambitious targets and yield enormous cost savings relative to a scenario without forest carbon markets (Fuss *et al.* 2020).

IV. Managing the risks of forest carbon markets

Concerns about forest carbon markets and the use of credits fall into four categories, as presented in Table 1: environmental and social integrity on the buyer or "demand" side of any transaction, and environmental and social integrity on the seller or "supply" side. This section summarizes the key issues and discusses how the risks can be managed.

For the most part, these concerns are not unique to forest carbon credits. For example, most demand-side risks described further below are pertinent regardless of the source of credits. Similarly, carbon credits from all sectors face challenges in managing risks related to non-additionality, leakage, and impermanence (Espejo *et al.* 2020). One concern specific to forests deserves consideration, however: the argument that emissions reductions from biological carbon sources are not commensurate with fossil emissions over very long time periods. The difference is because burning fossil fuels releases carbon into the atmosphere that would otherwise be fixed permanently in oil, gas, and coal reservoirs, and is thus irreversible, while reducing emissions from deforestation involves carbon that is in the biospheric portion of the carbon cycle and as such is subject to natural processes that could cause some of it to be released it to the atmosphere — e.g., fire, drought, wind (IGBP Terrestrial Carbon Working Group 1998). In practice, this concern can be largely mitigated by provisions to ensure "permanence" of forest emissions reductions or removals over larger spatial scales, for example via jurisdictional approaches, as discussed below.

TABLE 1: Risks to be managed in the use of forest carbon credits

		DEMAND-SIDE RISKS	SUPPLY-SIDE RISKS
TYPE OF RISK	Environmental integrity	<p>Concern that use of credits will reduce own abatement and/or investment in future abatement technologies.</p> <p>At the level of a country, concern that making credits available will reduce or retard the pace of decarbonization efforts.</p>	<p>Concern that credits fail to represent “real” or permanent emissions reductions or removals, due to inflated baselines, leakage, reversals and other issues.</p> <p>At the level of a country, concern that the opportunity to sell credits will lead to less ambitious targets.</p>
	Social integrity	<p>Concern that use of credits will allow continued pollution affecting communities living near emitting facilities.</p>	<p>Concern that interventions to protect or enhance forest carbon will have adverse impacts on communities living in and near forests.</p>

Source: Based on Seymour and Langer 2021.

More fundamentally, the commensurability concern is a question of time scale; while it applies over periods of centuries, and thus is relevant to long-run climate stability, it should not obscure the very real value to stabilizing the climate that reductions in forest emissions can provide over multi-decadal scales – which are the ones immediately relevant to policy makers. Indeed, because tropical forests cannot be easily replaced once lost, the carbon they contain is irrecoverable over human-relevant time scales (Goldstein *et al.* 2020). For these reasons, channeling finance into forest protection, including through the use of carbon markets, represents an urgent and time-sensitive priority (see also Box 4).

Demand-side environmental integrity

The primary concern raised by the use of carbon credits to offset emissions is that countries or companies will simply purchase lower-cost credits in lieu of reducing their own emissions and/or investing in new low-carbon technologies needed for future abatement. If offsets are seen as facilitating the avoidance or delay in abatement, and therefore overall climate ambition, the legitimacy of carbon markets will be undermined. In earlier debates about including forest carbon credits in international compliance markets, it was feared that their relatively low price compared to other mitigation options

would lead to “flooding the market” (Seymour and Busch 2016).

There are several ways that these risks can be managed. In compliance markets, policy makers can limit the percentage of an entity’s compliance obligation that may be met with offsets, as California has done. More broadly, policy makers have other means of ensuring the environmental integrity and ambition of their programs: they can include offsets as part of a package of other measures to reduce emissions within a sector, as in CORSIA; or they can account for the use of credits from outside of capped sectors, and set the stringency of the overall emissions limit accordingly. Advocates for including such credits argue that allowing their use has helped give policy makers the confidence needed to establish pollution limits in cases such as CORSIA, California, and Korea. In addition, policy-makers can increase stringency over time, as the European Union, California, and the Regional Greenhouse Gas Initiative (RGGI) have all done in the context of reviewing or extending their cap-and-trade programs.

In voluntary carbon markets, corporate purchasers can build confidence that offsets are additional to (rather than a substitute for) own abatement, for example by adopting the SBTi Climate Positive approach described in Box 3. Clear and transparent

TABLE 2: Managing demand-side risks to environmental integrity

CONCERN	ILLUSTRATIVE SOLUTIONS
Reduced climate ambition	<p>Companies can build confidence that the use of forest carbon credits are a complement to, rather than a delay tactic or substitute for, aggressive efforts to reduce fossil fuel emissions.</p> <ul style="list-style-type: none"> Companies publish and regularly update a credible decarbonization strategy for reducing their own emissions (scopes 1, 2, and 3), ideally with a Paris-aligned target (SBTi) Company leadership pledges to reach net-zero by midcentury at the latest (e.g., Race to Zero, United Nations Global Compact 1.5°C pledge) Companies take immediate action towards achieving net-zero, detail the reduction approaches, set interim targets, and demonstrate how NBS as offsets are a transition strategy to compensate "residual" emissions (Race to Zero)
Lack of transparency	<p>Companies can disclose information on implementation that is sufficiently detailed and timely for stakeholders to monitor progress.</p> <ul style="list-style-type: none"> Companies publish independently-verified annual reports on progress in implementing their own emissions reductions (in line with CDP and Task Force on Climate-related Financial Disclosure reporting requirements) Companies report progress at least annually (Race to Zero) Companies disclose information regarding types, sources, and prices of offsets
Lack of coherence in corporate strategy	<p>Companies can ensure that all corporate strategies are aligned with Paris Agreement goals.</p> <ul style="list-style-type: none"> Companies commit to an investment strategy aligned with their climate strategy (e.g., energy companies commit to an increasing percentage of investments allocated to clean fuels versus fossil fuel development) Companies establish key performance indicators consistent with climate strategies and incentivize employees (e.g., annual bonuses) based on achievements Companies commit to avoid any lobbying, direct or through trade associations, related to climate policy that is inconsistent with a Paris-aligned future
Misleading claims	<p>Companies can ensure that any claims based on the integration of forest carbon credits into mitigation strategies do not mislead consumers or other stakeholders.</p> <ul style="list-style-type: none"> Companies ensure that claims adhere to the International Social and Environmental Accreditation and Labeling Alliance principles and guidance for sustainability claims (i.e., transparency, relevance, impartiality, engagement, and truthfulness) and emerging guidance on the use of terms such as "carbon neutral" Companies ensure that marketing of "carbon neutral" products do not result in a rebound effect of increased consumption of emissions-intensive goods

Source: Based on Seymour and Langer 2021.

communication by companies about their use of credits, including the extent to which such purchases represent contributions to help developing countries meet their NDCs, can also mitigate these concerns. Third parties — including civil society organizations or even government regulators — can help to monitor and ensure such transparency.

Table 2 lists a range of demand-side risks to environmental integrity in the context of corporate commitments, and approaches to managing them.

Supply-side environmental integrity

Another key concern applicable to the use of all offsets in carbon markets is whether the carbon credits used to counterbalance fossil fuel emissions are of sufficiently high quality to represent a real reduction from the perspective of the atmosphere. Confidence in the quality of credits requires attention to the issues such as *additionality* (emissions reductions and removals must be additional to what would have happened in a “business-as-usual” scenario); *leakage* (activities that cause emissions are not simply displaced elsewhere); *permanence* (reversal risks are mitigated); and *double counting* (each tonne of emissions reduction generates only one credit, and credits are retired only once, and are used towards only one compliance obligation). Confidence in the quality of carbon credits was shaken by a study commissioned by the European Commission that estimated that most project types included in the Clean Development Mechanism (CDM) under the Kyoto Protocol to the UNFCCC — especially energy-related projects — were unlikely to be additional (Cames *et al.* 2016).

In prior debates about carbon markets (such the CDM and the European Emissions Trading System), forest carbon credits were seen as especially risky due to the difficulties in measuring forest carbon fluxes, and credits from forest-based emissions reductions were excluded from the programs. Those concerns have been largely alleviated by the astonishing advances in methods for the measurement, reporting, and verification (MRV) of emissions reductions and removals enabled by satellite, computing, and other technologies. It is now possible to map forest-related greenhouse gas emissions and removals globally at a resolution of 30 meters (Harris *et al.* 2021).

As with any crediting outside of capped sectors where emissions reductions must be measured against a benchmark level, forest carbon credits are at risk of not being additional if baselines against which emissions reductions are measured and credited are inflated. This concern is exacerbated in voluntary programs, as actors with more favorable baselines and thus more to gain from crediting are more likely to choose to participate, resulting in an “adverse selection” problem (van Benthem and Kerr 2013). Forest credits, especially at the project level, are seen as particularly vulnerable to leakage: the leading cause of deforestation — conversion of forests to produce globally traded agricultural commodities such as beef and soy — can readily be displaced from one area to another.

A final risk is reversal from natural disturbances, particularly as the capacity of forests and other ecosystems to capture and store carbon may be compromised by the increased frequency and severity of droughts, wildfires, and other effects of climate change (Anderegg *et al.* 2020), and forest loss from such events was evident in 2020 tree cover loss data (Weisse and Goldman 2021).

Importantly, crediting at the scale of large jurisdictions is itself an approach to reducing many of the supply-side risks. For example, the risk of leakage is lower, and measurement errors relatively smaller, when emissions reductions are measured and credited across larger areas (Andersson and Richards 2001; Schwartzman 2021). And although there appears to be some convergence across the various jurisdictional-scale crediting schemes, there is continuing debate regarding the best methods for assessing and managing the various sources of risk. As shown in Table 3, a number of other approaches to managing these risks have also been developed in the context of REDD+, including prescriptive methods for setting reference levels, discounting for the risk of leakage, and buffer pools for the risk of impermanence.

In the context of ITMOs transferred under Article 6.2 of the Paris Agreement, risks to supply-side environmental integrity also include the concern that the opportunity to sell carbon credits will lead tropical forest countries to “game the system” by setting or maintaining weaker NDCs, in order to generate more credits for sale.⁹ It is not clear *a priori* why this risk is

⁹ A distinct supply-side concern is that tropical forest jurisdictions will systematically sell their lowest-cost emissions (or “low-hanging fruit”), hamstringing later efforts to meet their own domestic targets. This concern can be mitigated by ensuring that tropical forest governments have control over the sale of forest carbon credits generated inside their countries — as is necessarily the case under jurisdictional REDD+ programs. As long as the jurisdiction chooses whether or not to generate and sell credits, there are little grounds for outside observers to criticize that choice.

TABLE 3: Managing supply-side environmental integrity risks

CONCERN	APPROACHES TO RISK MANAGEMENT
Leakage	Ensure that activities that generate emissions are not simply displaced: <ul style="list-style-type: none"> Discount crediting to reflect the assessed risk of direct and indirect leakage Credit at the scale of national or large subnational jurisdictions
Permanence	Ensure that emissions reductions and removals are not reversed – or if reversed, are compensated: <ul style="list-style-type: none"> Require risk mitigation measures Require long-term monitoring and reporting Require mechanisms to compensate for reversals (e.g., withholding credits in buffer pools)
Additionality	Ensure that emissions reductions and removals are “real” and would not have happened anyway: <ul style="list-style-type: none"> Require crediting reference levels to be established in ways that avoid “cherry-picking” reference periods and inflated baselines Use jurisdictional-scale historical emissions, conservatively adjusted in the case of high forest, low deforestation countries Require periodic updates of reference levels over time (e.g., every 5 years) without allowing increases, in order to ensure increasing ambition
Accuracy of measurement	Ensure that reporting on emissions reductions and removals is accurate: <ul style="list-style-type: none"> Utilize data and methods consistent with Intergovernmental Panel on Climate Change (IPCC) guidance Take advantage of new monitoring technologies and use conservative approaches
Uncertainty	Ensure that the risk of measurement errors is reduced: <ul style="list-style-type: none"> Discount crediting to reflect the assessed uncertainty in the monitoring data and calculation methods
Social safeguards	Ensure that programs do not harm affected communities and that benefits are equitably shared: <ul style="list-style-type: none"> Independently verify implementation of a national safeguard system
Double counting	Ensure that each credit for emissions reductions is claimed only once: <ul style="list-style-type: none"> Certified emissions reductions are unique and maintained on a registry Internationally transferred post-2020 credits used toward another country’s NDCs or other compliance obligations are reflected in corresponding adjustments to the host country’s NDC, following guidance under Article 6 of the Paris Agreement

Source: Adapted from Seymour and Langer 2021.

greater than the possibility that the opportunity of international cooperation will lead to greater ambition (the stated goal of Article 6). Nonetheless, to the extent it is a concern, this risk can be addressed in three ways. First, since all transactions are voluntary, Parties purchasing ITMOs can choose to buy only from countries with sufficiently ambitious NDCs.¹⁰ Second, the “progression” requirement of Article 4.3 of the Paris Agreement requires that successive NDCs represent increasing ambition. The risk of “gaming” can be mitigated by holding countries to that requirement — and in particular, by ensuring that UNFCCC guidance under Article 6 requires host countries to account for ITMOs that originate from outside the sectors included in their NDC, in order to eliminate an incentive to keep forests outside the scope of their NDCs. Third, jurisdictional REDD+ standards can require host countries to include forests in their NDCs and can impose a requirement that the emissions baseline be periodically updated and cannot increase, effectively ensuring increasing ambition at least with respect to the emissions reductions available to generate credits.

Social integrity on the demand and supply sides

In addition to concerns about the environmental integrity of carbon markets, there are concerns about the social integrity of carbon credits on both the demand and supply sides — in other words, concerns that communities on both ends of a carbon credit transaction could be affected in ways that make them worse off than they would have been in the absence of the transaction.

On the demand side, if offsetting allows companies to continue to emit pollutants associated with burning fossil fuels at higher levels than would otherwise have been the case, the health of communities adjacent to polluting facilities will be adversely affected. Although CO₂ emissions themselves are not a direct threat to local public health, they may be correlated with air toxics as well as emissions of sulfur dioxide, nitrogen oxides, and particulate matter that contribute to local pollution and associated morbidity and premature mortality. Such threats have implications for social justice, as polluting industrial facilities tend to be located in low-

income communities and communities of color that have been disproportionately burdened by pollution. Such concerns can be directly addressed by other environmental regulations, such as permitting requirements for industrial facilities and stringent enforcement of health-based limits on local air pollution. Carbon market design elements, such as limits on the use of offsets and provisions to ensure that any purchase of carbon credits is genuinely additional to own abatement, can also contribute to addressing these concerns.

On the supply side, the concern is that the generation of carbon credits can have adverse consequences for local communities resulting from how emission reductions and removals are produced. For forest-based credits, the concern is that placing a value on carbon will lead to changes in land use and access to forest resources in ways that will adversely affect the rights and livelihoods of indigenous and local communities, thus raising social justice concerns. Concerns have also arisen about whether revenues from carbon credits will be used to benefit local communities. More broadly, carbon offsetting has been criticized for being an instrument of “carbon colonialism”: that is, exploiting the power imbalances that are a legacy of colonialism to unfairly distribute the burdens of climate mitigation efforts from industrialized countries to the Global South.¹¹ Although the discourse pre-dates REDD+, the concept often informs critiques of REDD+ projects that are alleged to have displaced or otherwise harmed local communities through restrictions on access to forest resources, or condemning them to poverty through low prices for forest carbon credits.

Again, such risks are not unique to forest carbon credits; the construction of hydroelectric dams that generate credits from renewable energy can displace local communities (and indeed has done so at massive scale in the Brazilian Amazon). However, the need to manage such risks has been a key focus of REDD+ negotiations and program design, resulting in the elaboration of principles and methods for the implementation of social safeguards, including ensuring that local communities have a voice in the design of programs and the distribution of benefits.

Box 5 illustrates how concerns about social integrity

¹⁰ Indeed, proposals for coalitions or “clubs” of carbon markets often envision that bilateral carbon market purchases would be conditioned on ambition. See, e.g., Keohane et al. (2017).

¹¹ See, for example, Eberle et al. (2019): https://www.researchgate.net/publication/337622634_Carbon_Colonialism_A_postcolonial_assessment_of_carbon_offsetting

have featured prominently in considerations by California of whether to allow REDD+ credits in the state's carbon market.

V. Challenging transitions

In order to achieve the needed halt and reversal of tropical deforestation by the end of this decade, fundamental transformations in the politics and economics of forest land use will have to take place. Generating large-scale finance through international carbon markets is one way to challenge the current incentive structures that drive deforestation and constrain restoration efforts.

However, at the beginning of this critical decade, neither forest-rich countries (the supply side) nor companies and governments on the demand side

have all the necessary elements in place to liberate the needed financial flows. This section describes four transitions that need to be accelerated in the near term.

From projects to jurisdictional-scale crediting

A first challenge to be addressed early in this decade is to align project-scale and jurisdictional-scale crediting for forest-based emissions reductions and removals (see Box 1 for an introduction to terms).

Proponents of continued direct crediting at the project level include project developers and investors (both for-profit and non-profit), standard-setters and verifiers, and buyers of project-scale credits. They argue that continued project-level crediting is essential to attract private sector finance and build

BOX 5. California's Tropical Forest Standard: Social integrity comes to the fore

In November 2019, after years of intensive development at the staff level, including extensive expert consultation and public input, the California Air Resources Board (CARB) endorsed the California Tropical Forest Standard (TFS). The proposal touched off fierce debate in the state; indeed, CARB first considered the TFS in 2018 only to table it when it became clear that it lacked sufficient support to pass.

The public debate over the TFS highlighted the relevance of social integrity — on both sides of the issue.

The TFS faced staunch opposition from environmental NGOs and environmental justice organizations who expressed concern that allowing facilities in California to purchase international credits to offset a portion of their greenhouse gas emissions would lead to concomitant increases in local air pollution, disproportionately affecting low-income communities and communities of color already burdened by pollution. At the 2018 board meeting, for example, residents of the city of Richmond (home to one of the CARB members) spoke powerfully about their experience living in the shadow of a major refinery. Many of those

organizations also expressed similar concerns about the market-based approach inherent in the state's cap-and-trade program as a whole. Nonetheless, the concerns proved especially salient in the context of emissions reductions outside the United States. Some of the opponents of the TFS also claimed that the use of market-based REDD+ would lead to land grabs or exploitation of indigenous peoples.

Arrayed in support of the proposal were other environmental organizations, a number of scientists, the Governors Climate and Forest Task Force (a coalition of states and provinces known as the GCF that includes tropical forest jurisdictions), and representatives of indigenous peoples in the Amazon as well as California's Yurok tribe. Advocates pointed out that protecting tropical forests was critical to stabilizing the climate and argued that the state had an opportunity to demonstrate global leadership on REDD+. They, too, raised the importance of social integrity — but argued that it favored approval of the TFS. Central to these arguments were the Principles of Collaboration developed by the GCF and indigenous leaders to ensure that jurisdictional REDD+ programs adhere to social safeguards such as guidelines for how jurisdictions should engage with local and Indigenous communities.¹²

¹² See https://gcftf.org/wp-content/uploads/2020/11/Guiding_Principles_ENG.pdf.

capacity for forest protection and restoration efforts.¹³ They further question the degree to which jurisdictional-scale programs can respect private property rights, ensure permanence in the face of political change, demonstrate additionality, and address uncertainty of measurement of emission reductions and removals. They doubt whether governments can develop the capacity to implement jurisdictional-scale programs reliably and well and worry that worthy projects will be starved of revenues in the meantime.

Proponents of jurisdictional-scale crediting include selected governments, environmental and conservation organizations, research institutes, and prospective corporate buyers. They stress the need for incentives that encourage governments to implement the legal, policy, and regulatory measures needed to end deforestation at scale, and question the viability of a theory of change based on scattered “islands” of projects to address drivers of deforestation in a larger forest landscape.¹⁴ Proponents of jurisdictional-scale crediting are also concerned that a continued market for project-scale credits will “use up” available reductions in forest emissions, effectively starving governments of the revenues needed to incentivize performance at scale. Further, they argue that jurisdictional-scale REDD+ programs are better able to manage the risk of leakage (which decreases with the size of a crediting area) as well as other environmental integrity concerns. They also point to evidence¹⁵ supporting the widespread suspicion that many projects are credited against inflated baselines, thereby generating “hot air.” They worry that exposure of poor-quality project-scale credits will delegitimize the inclusion of *any* forest-based emissions and removals in compliance markets and strategies to meet voluntary corporate emissions reduction targets.

The advantages that jurisdictional-scale crediting offers in addressing certain risks to environmental integrity — as well as a clear trend toward jurisdictional-scale crediting in compliance markets such as CORSIA and under the Paris Agreement — suggest that a transition is needed over the coming

years from the current voluntary market, which is dominated by project-scale credits. A consensus is emerging that as part of that transition, it will be necessary to “nest” existing projects into jurisdictional-scale accounting for emissions reductions and removals as soon as possible to avoid double counting.¹⁶ Transitioning existing projects to align with jurisdictional crediting levels will in many cases be difficult, necessitating convergence around a common accounting methodology in each jurisdiction and, in many cases, requiring project-level baselines to be adjusted downward in order to align with jurisdictional accounting, resulting in a potential “haircut” for project developers and investors.

Governments that supply jurisdictional-scale REDD+ credits to the international market will need to develop policies and institutions for encouraging site-level investments as well as for the sharing of proceeds — or “benefit sharing” — with indigenous and local communities, as well as with other forest resource owners and managers within the jurisdiction, including REDD+ projects nested within those jurisdictions. Benefit-sharing arrangements address multiple objectives, including incentivizing future performance in generating emissions reductions and removals as well as respecting resources rights and enhancing equity. While such requirements are only implicit in the safeguard principles negotiated under the UNFCCC, they have emerged as criteria important to prospective corporate purchasers of credits as well as to governments.

While REDD+ safeguard principles require that the process of negotiating benefit-sharing arrangements with relevant stakeholders be transparent and participatory, there is a broad range of potential outcomes of such negotiations. If governments want to incentivize future private sector investment in REDD+ projects, project-level performance in generating emission reductions and removals could be compensated in cash or through allocation of a share of credits generated at jurisdictional scale, or through other domestic policies (as Colombia has done with its carbon tax). How to apportion the risk

¹³ See, for example, Duncan van Bergen (2020): <https://www.ecosystemmarketplace.com/articles/shades-of-reddwhy-the-world-needs-both-projects-and-policies-to-save-forests/>

¹⁴ See, for example, Seymour (2020): <https://www.wri.org/blog/2020/05/insider-4-reasons-why-jurisdictional-approach-redd-crediting-superior-project-based>

¹⁵ See, for example, West et al. (2020): <https://www.pnas.org/content/117/39/24188>

¹⁶ See, for example, Hamrick et al (2021) https://www.nature.org/content/dam/tnc/nature/en/documents/REDDPlus_PathwaystoBridgeProjectandJurisdictionalPrograms.pdf

of non-performance at the jurisdictional scale will be a key point of contention. The experience of the Forest Carbon Partnership Facility (FCPF) Carbon Fund, which requires preparation of benefit sharing plans as part of negotiated emissions reductions payment agreements with participating countries, has generated many lessons.

From public to market-based financing

Another transition that must take place over the next decade is a shift in the role of public finance as large-scale market-based finance becomes available. Such a shift has been anticipated for more than a decade, with several bilateral and multilateral results-based finance programs explicitly designed to serve a bridging function to international carbon markets. The three phases of REDD+ finance (readiness, implementation, results-based) were envisioned as ways to support countries to put institutional infrastructure (such as monitoring systems) into place, provide investment funds for actions to address causes of deforestation, and pilot results-based finance. The question of how to allocate scarce public funds for development assistance and climate finance among functions, geographies, and intermediary institutions is now facing donor agencies, with programs such as the Green Climate Fund's pilot program for results-based payments coming to an inflection point in 2021, and the FCPF scheduled to "sunset" in 2025.

In the meantime, more than 50 countries participating in REDD+ have progressed at varying speeds: a few are nearly ready to engage with international markets while many others are years away from doing so. A significant body of experience has been accumulated regarding the challenges of countries achieving "readiness" which, in many cases, will require continued public support. Where needed investments do not provide a commercial return even when coupled with market-based carbon revenues, domestic or international public support will be needed to leverage up-front private investment in implementation. And publicly supported results-based finance will be needed to motivate change in land use policies in some jurisdictions pending achievement of eligibility to participate in market-based transactions.

The new market for jurisdictional-scale credits is supported by public finance for the development of new standard-setting and verification bodies (such as

the Architecture for REDD+ Transactions) and platforms for catalyzing and aggregating sources of demand and supply (such as the Emergent Forest Finance Accelerator), as well as by a guaranteed floor price for credits to encourage supply in the face of uncertain future private market demand.

In addition, complementary public finance — whether domestic or international — will continue to be needed to address equity considerations among countries (and even areas within countries) that are differentially positioned to benefit from forest carbon markets, based on biophysical conditions as well as institutional capacity. Public funding will also be needed to promote progress toward other objectives, such as poverty reduction and biodiversity conservation, that are not easily captured in the CO₂ metric used in carbon market transactions.

Establishing acceptable ambition on the demand side

As voluntary demand for carbon credits continues to grow, the use of carbon markets must contribute to global climate ambition. As noted in the previous section, the inclusion of REDD+ in carbon markets can encourage countries to set more stringent emissions targets, and the use of carbon credits by companies toward voluntary climate commitments can contribute to society's net-zero goals when it is paired with significant "own abatement."

But there is not yet a complete, widely accepted set of rigorously determined sectoral abatement trajectories against which corporate buyers' voluntary commitments and performance can be assessed (see Box 3). While SBTi and other initiatives are making progress on filling this need, there is not yet consensus on "good enough" abatement performance for society to grant a social license to emitting companies to count forest carbon credits against their voluntary commitments without being subjected to legitimate accusations of greenwashing. Further, even when such sectoral guidance is available, companies will require a *de minimis* amount of time to develop their own targets and strategies and have them independently validated.

A particularly important lacuna concerns what might be termed the "interim" use of carbon credits by companies on the pathway to net-zero emissions. Achieving and sustaining net-zero emissions will ultimately require cutting emissions almost to zero

and balancing any remaining emissions with removals. As a result, at the future time when that goal is reached (i.e., the middle of the century), the global net-zero target must be met by removals alone, rather than by balancing ongoing emissions in some sectors or regions with reductions in emissions elsewhere (e.g., in tropical deforestation). However, it does not follow that along the pathway to that end state, it is only appropriate to counterbalance unabated emissions with removals. To the contrary, what matters for the climate is the accumulation of carbon emissions in the atmosphere. As a result, over the next few decades, reductions in emissions from tropical deforestation still have an integral role to play in achieving climate stability (see related discussion in Box 4). Current demand-side guidance, however, generally overlooks this critical period.

In the meantime, questions remain: (1) Is it acceptable for companies to begin financing forest carbon credits and making associated claims (e.g., “carbon neutral” product labels — see Box 6)? And (2) Even after consensus is achieved on demand-side requirements, who will police corporate adherence to agreed standards for participation in voluntary markets? An independent, civil-society-led Voluntary Carbon Market Integrity initiative (VCMli), launched in March 2021 with the support of the Children’s Investment Fund Foundation and the UK Government, aims to provide authoritative guidance on how voluntary carbon credits can be used by corporates and other non-state actors as part of credible net-zero decarbonization strategies, including the “interim” issue identified above (Meridian Institute 2021).

Alignment between voluntary and compliance markets as the Paris Agreement comes into effect

A final transition concerns alignment of international transactions with the Paris Agreement on climate change. As illustrated in Table 4, there are four distinct types of transactions in forest carbon credits: those that take place in voluntary and compliance markets within national borders, and those that involve the transfer of credits from one country for use in voluntary and compliance markets abroad. Issues raised by the Paris Agreement relate to the latter two cases only.

BOX 6. Carbon neutral gasoline?

A perennial concern about carbon offsetting is that it will let rich countries and companies “off the hook” for abating their own emissions. With the marketing of “carbon neutral” products, such concerns extend to ultimate consumers as well. Although the use of carbon credits from any source raises similar concerns, offsetting fossil fuel emissions through intrinsically attractive forest conservation or tree-planting efforts in particular raises the risk of corporate “greenwashing,” i.e., misleading customers about the true carbon footprints of companies and consumers of their products.

In 2019, Shell began offering consumers in the Netherlands and the UK the option to “drive carbon neutral” by paying a surcharge at the gas pump.¹⁷ Shell uses the proceeds to generate forest carbon credits through forest protection and restoration efforts. Although the company characterizes the program as an interim solution pending society’s switch to electric vehicles, some critics have complained that the marketing of carbon neutral gasoline could mislead customers into believing that purchase and consumption of fossil fuels is a climate positive action. Others are concerned that unless accompanied by a corresponding adjustment in source country accounting, the use of such credits to back of carbon neutrality claims could represent double counting.

In the case of internationally transferred mitigation outcomes used toward fulfillment of an NDC, the UNFCCC Decision framing the Paris Agreement (1/CP.21) makes clear that double counting is to be avoided on the basis of a “corresponding adjustment”: essentially double-entry bookkeeping, where an emission reduction transferred internationally is added back to the books of the host country and the result is subtracted from the books of the purchasing country to reflect the impact of the emission reduction. Such adjustments are vital to ensure that emissions reductions that occur in one country but are used by another to meet its NDC are only counted toward one country’s target. A parallel provision in CORSIA requires that eligible offset

¹⁷ See <https://www.shell.co.uk/media/2019-media-releases/drivers-set-to-go-carbon-neutral-with-shell.html>.

TABLE 4: Typology of forest carbon credit transactions

	VOLUNTARY	COMPLIANCE
Domestic	NBS credits purchased by companies to meet voluntary, unregulated commitments to compensate emissions within national borders.*	NBS credits purchased by companies to meet compliance obligations within national borders.*
International	NBS credits purchased by companies to meet voluntary, unregulated commitments with source of emissions in another national jurisdiction.*	NBS credits purchased by companies or countries to meet compliance obligations in another national jurisdiction. ERs transferred to purchasing company or country for use toward a compliance obligation or fulfillment of an NDC, respectively. Corresponding adjustments required.

*Emissions reductions (ERs) reductions remain within the host country to be used toward fulfillment of its NDC. No corresponding adjustment required under Paris Agreement (although may be a condition of sale).

Source: Revised and updated based on Seymour and Langer 2021.

programs have provisions in place to avoid double counting according to international rules, to ensure that credits used by airlines toward their obligations in CORSIA are not also used toward a country's NDC. While guidance on accounting for ITMOs under Article 6 of the Paris Agreement has yet to be finalized, the basic structure of what Parties must report on ITMOs is in place as part of the "structured summary" required under the transparency framework of Article 13.

The extent to which Paris Agreement accounting standards — in particular, the requirement for corresponding adjustments — should be extended in practice to international carbon market transactions to meet voluntary goals remains under debate. The matter touches on a number of central issues, including the nature of the claim that companies seek to make (or should be allowed to make, from a normative perspective) on the basis of purchases of carbon credits as well as the importance of not only channeling finance to countries to help them meet their NDCs but also maintaining strong incentives for those countries to increase ambition over time in line with the "progression" envisioned in Article 4.3 of the Paris Agreement.

Some stakeholders have raised concerns that the use of an emission reduction toward both a compliance purpose and a voluntary climate commitment, in the absence of a corresponding adjustment, constitutes double counting. An emerging view among many other stakeholders is that there are parallel accounting systems for voluntary and compliance markets. If a company purchases a carbon credit and uses it towards a voluntary commitment, the underlying emission reduction (i.e., the reduced emission from deforestation, for a jurisdictional REDD+ credit) accrues to the host country for the purposes of Paris NDC accounting. It does not contribute to the implementation and achievement of the NDC of the host country of the buying company. So, for the purposes of the Paris Agreement, the credit is not double counted (as noted in Section IV, companies should still provide clear and transparent communication to customers and other stakeholders about their use of credits toward their commitments). If, on the other hand, the credit is used for compliance purposes, it essentially "counts" towards the achievement of the buying country NDC (or another international mitigation commitment such as those established under CORSIA) and would be double counted in the

absence of a corresponding adjustment.¹⁸

The contours of such a system are still under development, and the relationships among corresponding adjustments, ambition, and additionality will be critical ones to resolve in the coming years, especially once the Article 6 guidance is finalized. Success will depend on clear and transparent reporting, accounting, and public communications by companies, as well as monitoring over time to ensure that voluntary purchases of carbon credits not only help countries to fulfill their existing NDCs, but encourage and enable them to make — and meet — progressively more ambitious targets over time.

VI. Roles for public and philanthropic investment

As the previous sections have shown, enormous progress has been made in recent years to develop high-integrity markets for forest carbon credits, although significant challenges remain. However, complementary public and philanthropic support over the next 10 years will still be crucial for ensuring that the standards and norms governing international carbon markets, and the capacities of market participants, evolve in ways that conserve environmental and social integrity and political viability. This section summarizes several opportunities for such support to do so.

Building consensus

As described above, the inclusion of forest-based credits in international carbon markets is challenged by a number of contested propositions and norms that are not yet agreed upon among key stakeholders. Public and philanthropic support can play a key role in creating platforms for stakeholder negotiation that are perceived as transparent and neutral. The recent experience of initiatives attempting to tackle these issues — such as the Taskforce on Scaling Voluntary Carbon Markets or the Natural Climate Solutions Alliance (co-convened by

the World Economic Forum and the World Business Council on Sustainable Development) — have demonstrated the limitations of platforms perceived as non-transparent or overly dominated by corporate interests.

One model that could be adapted to current needs is the process that generated Options Assessment Reports for REDD+ negotiators between 2009 and 2017 with philanthropic support.¹⁹ A series of meetings among recognized experts and UNFCCC negotiators professionally facilitated by a neutral third party generated authoritative guidance on complex technical issues. Similar processes could be adapted to address current thorny issues associated with private investment, such as the reconciliation of project-scale and jurisdictional-scale REDD+ crediting.

Another set of opportunities for such an options assessment and consensus-building approach relate to whether and how the non-GHG values of forests can be incorporated into forest carbon markets. For example, as described in Section II, new science is illuminating the multiple pathways through which forests affect climate stability other than via carbon sequestration and storage. If the non-GHG impacts of forest cover change on the global climate can be expressed as CO₂ equivalents, should forest carbon units be discounted or amplified accordingly in REDD+ crediting systems? Similarly, the international community has not yet solved the problem of how to reward so-called “High Forest Low Deforestation” countries — which do not have much potential for generating REDD+ credits precisely due to their low historical levels of deforestation and forest degradation — for the multiple and irreversible values of the world’s remaining intact forests.

Such consensus-building platforms need to be replicated across scales. In addition to establishing international norms on such issues when corresponding adjustments are needed for the transfer of REDD+ credits, there are issues such as benefit-sharing arrangements that can only be addressed at the level of national policy arenas or sub-national jurisdictions.

¹⁸ As an example, the LEAF Coalition sets out four potential pathways for emissions reductions (ERs) transacted through the Coalition: (1) results-based payments (RBPs) by sovereigns, under which ERs are immediately retired on the ART registry and the underlying mitigation outcomes may be used by the host country toward its NDC; (2) the same RBP approach by private sector buyers; (3) private sector buyers take title to the ERs for voluntary use only, while the underlying mitigation outcomes remain with the host country to be used toward its NDC, to be transparently communicated by the private sector buyer; and (4) private sector buyers take title to ERs for which the host country makes a corresponding adjustment, in which case the ERs may be used by the buyer toward compliance purposes.

¹⁹ Described here: <https://merid.org/case-study/redd-options-assessments/>

Building capacity

Countries participating in REDD+ are arrayed across a spectrum of readiness to participate in international carbon markets. At one end of the spectrum, many countries will continue to need readiness and investment finance in addition to publicly-funded results-based finance to incentivize performance. While those countries at the other end of the spectrum may no longer need results-based payments from public sector funds, some may still continue to require assistance to develop new legal capacities and frameworks for entering into contracts with private sector entities seeking offtake of forest carbon credits, and establishing the policies and institutions necessary for effective nesting of REDD+ projects. Complementary support to indigenous and local communities to ensure that they have the capacity to represent their interests in jurisdictional-scale programs is also needed.

While existing bilateral and multilateral programs such as the UN-REDD Programme can build on their experience to date and in-country partnerships to continue providing needed support, complementary modes of building capacity have also proven effective. For example, initiatives that support the development of a community of practice across jurisdictions — such as the Governors Climate and Forest Task Force — can both build capacity and establish norms of good practice.²⁰

Innovative finance

Public and philanthropic investment can support the further development and growth of high-integrity forest carbon markets by catalyzing innovative approaches to finance, including:

- Guaranteed floor prices (such as what the Government of Norway has provided to the Emergent Forest Finance Accelerator);
- Upfront investments for jurisdictions and priority initiatives to deliver performance, including advance purchase commitments;
- Risk guarantees for investors, including the provision of first-loss capital in “layered” capital structures that include public and philanthropic funding alongside private investment;

- Catalytic finance to demonstrate and scale up strategic interventions; and,
- Support to jurisdictions to develop finance structures and strategies to attract and effectively deliver public and private finance, and rigorously demonstrate impacts.

Public and philanthropic funding can also support tropical forest jurisdictions in designing and implementing innovative policy frameworks, including public-private partnerships, that demonstrate how market-based REDD+ finance can channel funds into reducing deforestation on the ground while promoting new models of sustainable economic development and ensuring that benefits are shared widely. Recent examples of such approaches include the Brazilian state of Mato Grosso’s Produce, Conserve, Include (PCI) initiative; Mato Gross’s CONSERV program, which provides targeted compensation to private landowners who forego legal deforestation; the Responsible Commodities Facility fund, which is raising capital for zero deforestation soy production through a mix of green bonds and Cerrado soy buyers; and the Cerrado Funding Coalition, which provides financial incentives for Brazilian soy farmers to produce only on land that has already been cultivated.

Supporting independent monitoring, research, and advocacy

The political legitimacy of scaled-up international trade in forest carbon credits will depend crucially on public confidence that environmental and social integrity are being upheld. Over the last decade, an ecosystem of civil society initiatives, academic researchers, and activists has evolved alongside REDD+ implementation to provide such confidence and requires continued public and philanthropic support.

Elements of that ecosystem include:

- Independent monitoring of forest cover change and carbon fluxes (e.g., Global Forest Watch), and global commodity flows (e.g., Trase) to serve as a check on reporting provided by governments and corporations and inform advocacy and research efforts;

²⁰ See, for example, Seymour et al. (2020) for the case of Indonesia: <https://www.frontiersin.org/articles/10.3389/ffgc.2020.503326/full>

- Independent research to generate empirical evidence to support or challenge theories of change associated with forest carbon markets (such as whether or not markets lead to enhanced ambition on both the supply and demand sides), and to inform national-level REDD+ strategies; and,
- Advocacy campaigns to expose breaches of integrity on the part of supply-side sellers or demand-side buyers, or weaknesses in the standards and systems that certify integrity.

As described in Sections III and IV, the development of standards to ensure environmental and social integrity on the supply-side are well advanced — and indeed have been made possible in large part by public and philanthropic funding. Demand-side standards — such as expectations for corporate abatement prior to use of carbon credits as offsets, or the use of claims such as “carbon neutral” — are more nascent.

VII. Conclusion

Governments and companies have dramatically stepped up their commitments on climate change in recent years, including setting net-zero targets. Demand for forest carbon credits has surged in voluntary markets and seems poised to ramp up in compliance markets in the coming years. At the same time, improvements in scientific understanding, advances in measuring and monitoring emissions, development of robust standards, and practical experience implementing policies have put in place the technical and institutional frameworks needed for high-integrity forest carbon credits.

As a result, after years of effort by a wide range of stakeholders, we are on the cusp of realizing the potential of market-based REDD+ to enhance the global response to climate change by driving tropical forest protection at scale. Meeting this opportunity will require fully addressing remaining concerns about forest carbon markets; building consensus among a wide range of actors; and continued investment to promote environmental and social integrity of forest carbon markets and to ensure that the benefits of scaled-up finance are widely and equitably shared. Public and philanthropic investment has played a central role in the progress to date — and will remain indispensable in the decade to come.

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Forests and International Carbon Markets

Nathaniel Keohane and Frances Seymour

